Working Together

David Coley, University of Bath, UK

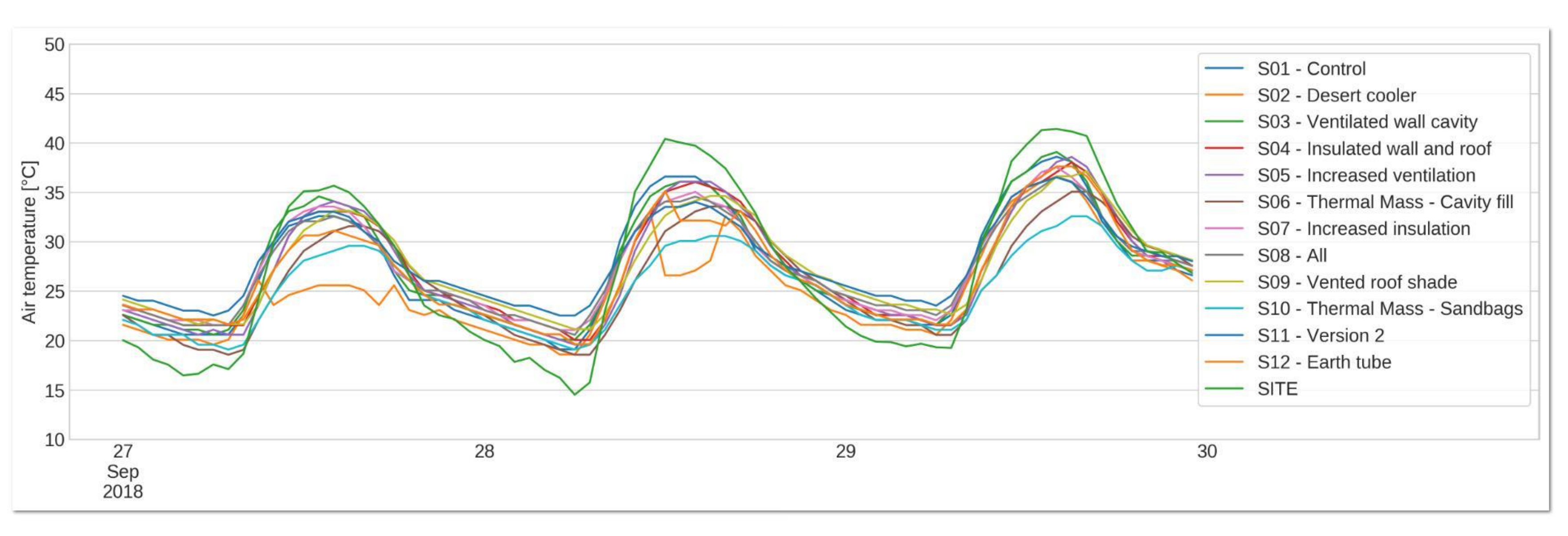
What the university sector can offer

1. Lots of clever people, young and old, most of whom know nothing about refugee camps, what IDP means, or issues in shelter.
2. A very wide range of skills, from anthropology to civil engineering.
3. A need for projects. We have thousands of MSc students needing projects (think 3 months of person power).
4. Possible PhD projects (think 2 years of person power).
5. The world’s best filing cabinet.

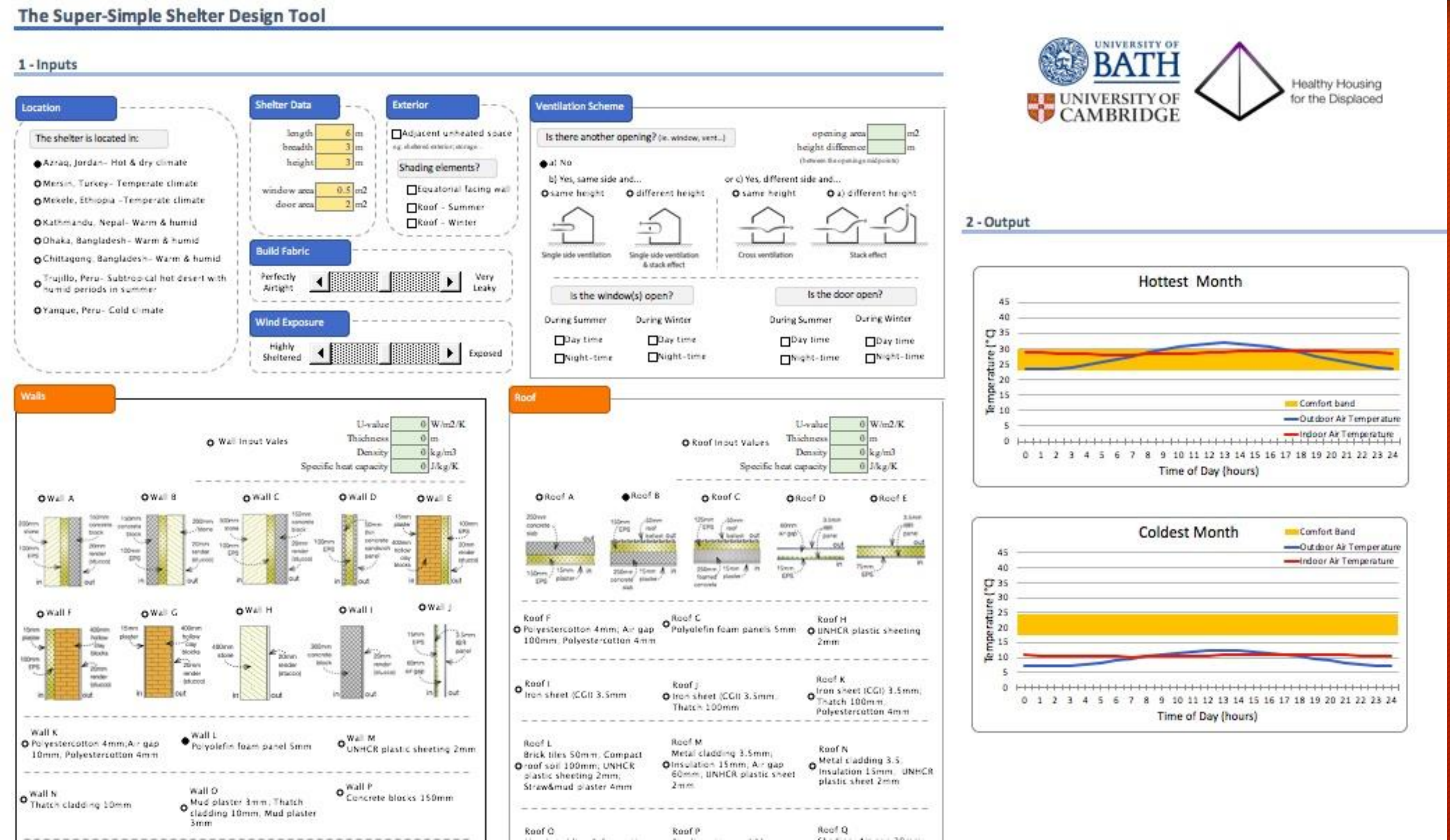
Example 1: CXB, footings

To use the tool, complete the yellow cells	Answers are given in green	Notes are in orange	
The key equation is, load = (1/2) x density of air x predicted wind speed ^2 x orography coefficient x pressure coefficient x area of object			
The orography coefficient accounts for the wind speed being higher at the top of a hill than the predicted wind speed for the overall site			
If the hill is H high (measured from the base of the slope), then if the shelter is less than H/2 up the slope, set the coefficient to 1; if it is above this point, set it to 1.5.			
Orography coefficient =	1.5		
The pressure coefficient accounts for different parts of the building being pushed and pulled more of less by the wind.			
For example, the overhangs will feel the wind more strongly than the main section of the roof.			
The Arup document suggests that one pitch of the roof might be sucked and the other pitch pushed down, or both pitches being sucked.			
As we are interested in the maximum pull force on the columns, we will just consider the latter.			
The first 0.5m from the edge of the roof will be exposed to more pressure than the rest of the roof. Overhangs will be exposed to even more, we therefore have to find the mean pressure coeffic			
Depth of overhang; O (m)	0.3	0 to 0.5	if greater than 0.5, set to 0.5
Depth of roof including overhang; R (m)	2.36	this is the distance from the outer point of the overhang to the ridge measured along the roof su	
Mean pressure coefficient	0.933050847		
The total force will depend on the area of the roof. As we are looking at the roof suction we will ignore whether the roof is hip or ridge			
Length of roof; L (m) =	5.9	including any overhangs	
Area of roof; A (m2)	27.848		
Number of columns in the building	13	the force will be shared equally over these	
Arup suggest looking at two wind speeds, that given in the Bangladesh building code for permanent buildings (91m/s), which occurs on average every 50 years, and			
52m/s, which occurs every 20 years. The latter being possibly relevant for temporary and mi-term shelters. We therefore complete the calculation for these two wind speeds below			
The force for other wind speeds is given on the next tab.			
The weight of the roof does not change the force on the roof, but does in theory reduce the pull resistance required by each column. If you don't which to include			
this effect, or you don't know the weight of the roof, set this to zero.			
Weight of roof (kg) =	50		

Example 2. T-shelter, Jordan

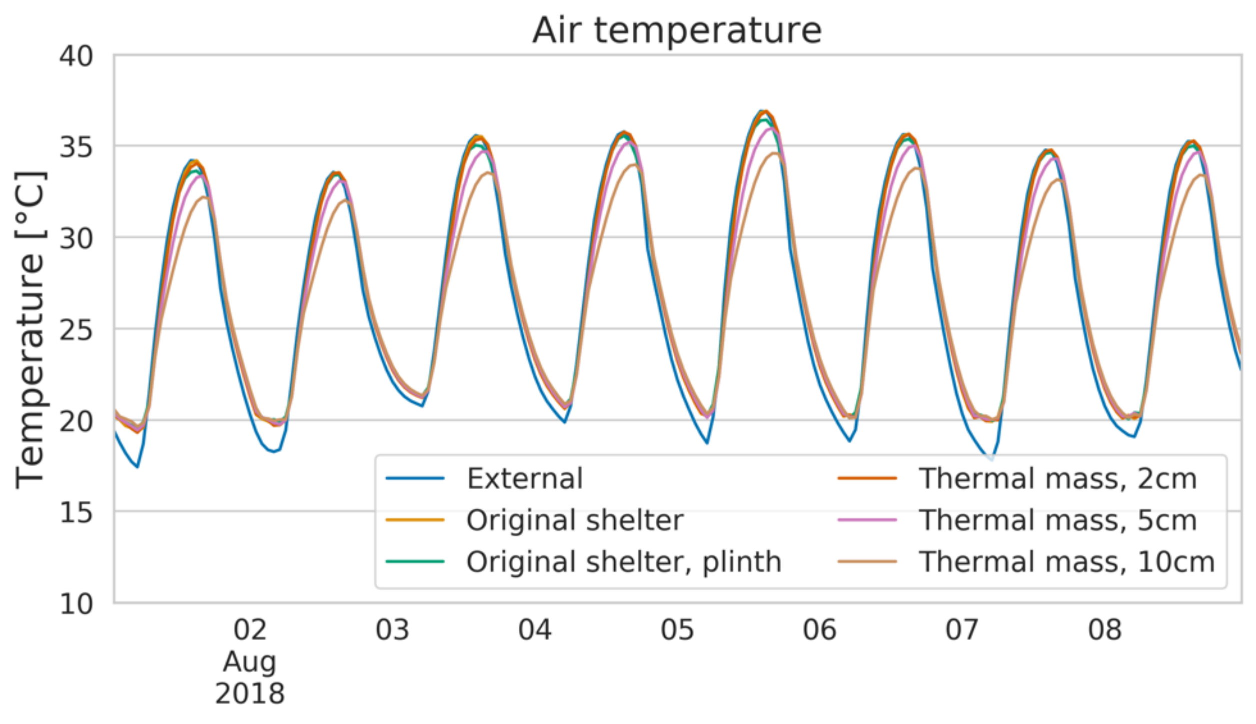


Example 3. Super Simple Thermal Model

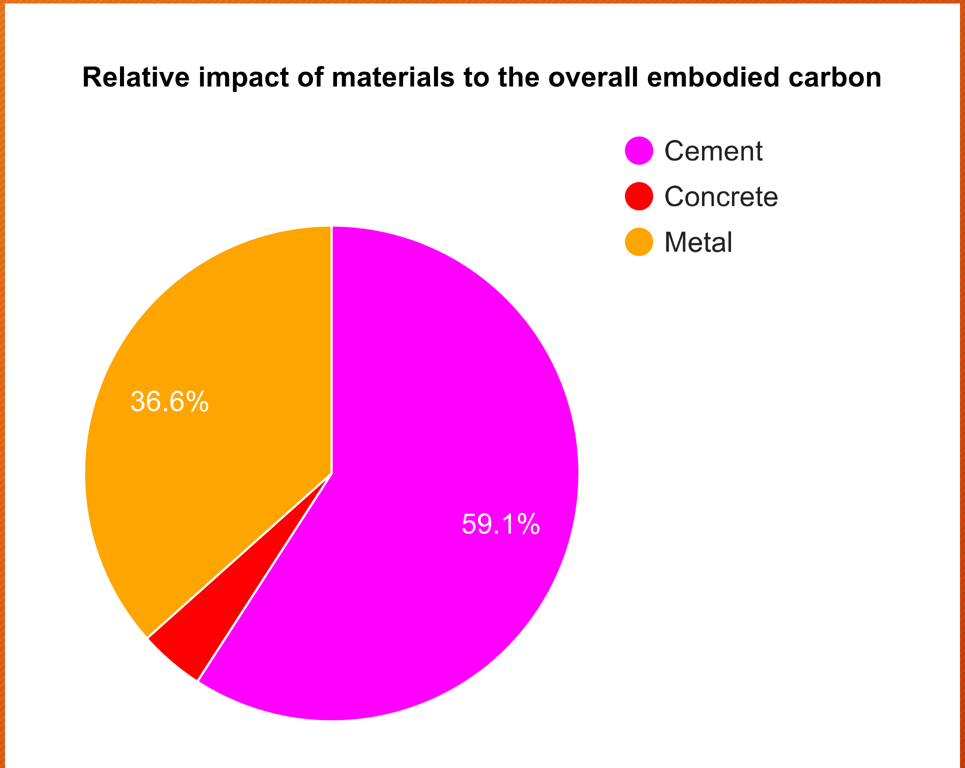


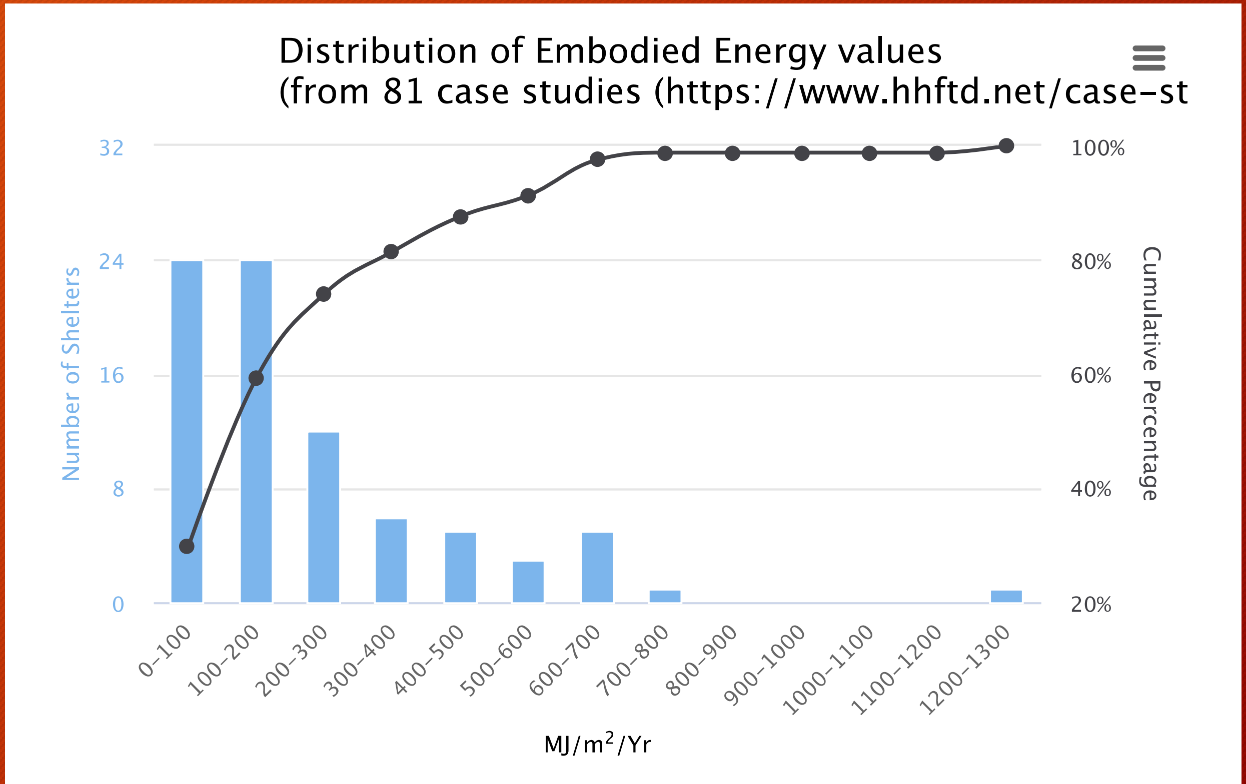
Gives the temperature in the shelter over a typical summer and winter day. Then compares it to the external temperature and the range of temperatures people normally consider comfortable. Most common materials and constructions can be found in the tool.

Example 4. Adding thermal mass



Example 5. Embodied energy





Example 6. Shelter assessment matrix

Shelter data

1. Practicality & Buildability

Basic Shelter requirements	The shelters should be able to maintain reasonable comfort conditions throughout the year: Ideally within the range 10ºC to 30ºC and 30% to 70% RH. A particular focus on issues of female privacy wrt those outside the shelter.
Required sub-divisions	At least 2 compartments
Shelter name	Enter the name of shelter

Design criteria	Issue	Details	Rating criteria	Importance of sub-issue: 0=n/a 1=Slight 2=Moderate 3=Important 4=Critical	How well does the shelter resolve sub-issue 1= Poor Up to 5=Very Good	Supporting evidence: 1. Modelling. 2. Prototype testing. 3. Established on-site performance	Performance of shelter per design criteria
Pre-construction	Cost	What's the approximate cost per shelter, fully constructed?	1. Equal or above 5,000 USD 2. Between 3000 to 4,000 USD 3. Between 2000 to 3,000 USD 4. Between 1000 & 2,000 USD 5. Equal or Below 1,000 USD	4	5	1 2 & 3	[illegible]
	Ease of Delivery	How easy is it to deliver and distribute shelter?	1. Requires specialist heavy lifting equipment (crane, forklift) 2. Requires large vehicle/trailer 3. Requires no lifting equipment but a small truck, and 4-6 people per shelter 4. Can be handled manually 5. Fabricated on site using locally available materials	3	4	3	12
Construction & Flexibility	Ease of construction	How many people are needed to construct one shelter? Are specialist skills/tools/equipment required/supplied with each shelter?	1. Requires specialist skills/tools and equipment). 2. Requires trained/skilled personnel to construct 3. Requires at least 4 people/moderate training & knowledge of construction/accessible tools). 4. Can be constructed by 3-4 untrained people 5. Does not require any specialist tools or training and can be constructed by fewer than 3 people).	4	4	1 & 2	16
	Speed of construction	How long does it take to construct a complete single shelter?	1. More than 7 days 2. 3 to 7 days 3. 1 to 2 days 4. 6 hours to a day 5. Less that 6 hours	4	4	3	16
		Is constructing the shelter in stages desired? If yes how well does the shelter address this requirement? If no choose 0 = n/a in column G	1. Not possible to build the shelter in stages 2. Not designed to be built in stages but its possible with significant increase in resources 3. Not designed to be built in stages but possible with moderate increase in resources 4. Can be built in stages with some minor efforts by the beneficiary 5. Integral design feature	0	1	2	0
	Adaptability	How easy is it to adapt the shelter to suit different beneficiary requirements? (How much freedom does the shelter beneficiary have to customise the shelter with given resources?)	1. Very difficult or not possible to do adaptations without compromising the structure). 2. Limited adaptability/customisation possible (e.g. only internal adaptations possible/ adding elements or zones). 3. External/internal adaptation is possible but might require careful consideration to avoid compromises to the structure. 4. Alteration to footprint of the building is possible (adding or removing a room) might require resources to do so. 5. Adaptability is an integral design feature (e.g. swap panels/move partitioning/ create windows/modular design).	3	1	1	3
		Will structure support hanging (heavy) items?	1. Can only support less than 5kg 2. Can support between 5-10kg 3. Can support 10 to 15kg 4. Can support 15 to 30kg	3	2	1	[illegible]

Shelter Data Summary

Shelter Name	All-singing, all dancing, go anywhere, build-anywhere shelter, Ltd		
	Max	Score	
Pre-construction	35	32	91%
Construction & Flexibility	90	47	52%
Lifetime Maintenance	70	26	37%
Comfort	125	28	22%
Sustainability	90	30	33%
Safety	65	18	28%
Protection	75	38	51%
Privacy	65	19	29%
Well-being & Adaptability	80	20	25%

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David Coley, University of Bath, UK
d.a.coley@bath.ac.uk